REMARKS

This application has been reviewed in light of the Office Action dated July 31, 2002. Claims 1-7 are pending in this application and have been amended to define still more clearly what Applicants regard as their invention. Applicants note that the changes to Claims 2-4 affect matters of form only and do not, in any way, narrow the scope of any of these claims. Claims 1 and 5-7 are in independent form. Favorable reconsideration is requested.

The Office Action rejected Claims 1-5 and 7 under 35 U.S.C. § 102(b) as being anticipated by European Patent Application No. 0920999 (Imanaka et al.). The Office Action also rejected Claim 6 under 35 U.S.C. § 103(a) as being unpatentable over Imanaka et al. in view of U.S. Patent No. 5,886,713 (Okada et al.). Applicants respectfully traverse these rejections.

Applicants submit that amended independent Claims 1, 5, and 7, together with Claims 2-4 dependent from Claim 1, are patentably distinct from Imanaka et al. for at least for the following reasons.

The aspect of the present invention set forth in Claim 1 is a liquid discharge apparatus. The apparatus includes a discharge port (see, e.g., FIG. 1, reference numeral 5) for discharging liquid; a liquid flow path (see, e.g., FIG. 1, reference numeral 7) in communication with the discharge port and having a bubble generating region (see, e.g., FIG. 1, reference numeral 10) for generating a bubble; a discharge energy generating element (see, e.g., FIG. 1, reference numeral 2) for generating thermal energy for generating the bubble in the liquid inside the bubble generating region 10; and a liquid discharge head facing the discharge energy generating element 2 spaced apart from the discharge energy generating element 2 having a movable member (see, e.g., FIG. 1, reference numeral 6) in which an end portion (see, e.g., FIG. 1, reference numeral 6a) at an

upstream side in the flow direction of the liquid inside the liquid flow path 7 is fixed and a down stream end thereof is a free end (see, e.g., FIG. 1, reference numeral 6b). In this apparatus, ink is discharged from the liquid discharge head and a recording is performed on a recording medium, such as for example paper, when the liquid adheres to the recording medium.

The liquid discharge apparatus also includes a means for detecting an ink supply state inside the liquid flow path 7 and a means for controlling or stopping the driving to the discharge energy generating element 2 when a judgment is made that the ink is present in the liquid flow path 7 *and* the ink is not normally supplied to the liquid flow path 7 based on the detection result of the ink supply state inside the liquid flow path 7.

One important feature of Claim 1 is that the driving of the discharge energy generating element 2 is controlled or stopped in a state where ink is present in a liquid flow path 7 *and* the ink is not normally supplied to the liquid flow path 7 based on the detection result of the ink supply state inside the liquid flow path 7. With this feature, the durability of the movable member 6 is improved because the driving of the discharge energy generating element 2 is controlled or stopped when a judgment is made that the ink is present in the liquid flow path 7 *and* the ink is not normally supplied to the liquid flow path 7 based on the detection result of the ink supply state inside the liquid flow path 7. By virtue of this feature, the present invention significantly reduces damage to the movable member or valve in a flow path. (It is to be understood, of course, that the scope of Claim 1 is not limited to the details of this embodiment, which is referred to only for purposes of illustration.)

Imanaka et al., as understood by Applicants, relates to a liquid ejecting head, head cartridge, and liquid ejecting apparatus. Imanaka et al. discusses a structure for stopping driving of a heat member when ink is *not* present in the ink flow path (see col. 4,

lines 12-19 as mentioned in the Office Action at page 3) based on an output of a temperature sensor. In contrast, the liquid discharge apparatus of the Applicants' Claim 1 controls or stops the driving to the discharge energy generating element 2 when a judgment is made that the ink *is present* in the liquid flow path 7 and the ink is not normally supplied to the liquid flow path 7 based on the detection result of the ink supply state inside the liquid flow path 7. Accordingly, at least for this reason, Applicants submit that Claim 1 is patentable over Imanaka.

Independent Claim 5 includes the same feature of controlling or stopping the driving to the discharge energy generating element 2 when a judgment is made that ink is present in the liquid flow path 7 and the ink is not normally supplied to the liquid flow path 7, as discussed above in connection with Claim 1. In addition, Claim 7 includes a similar feature of prohibiting or controlling the displacement of a movable member, which is related to the driving of the discharge energy generating element 2, as recited in Claims 1 and 5. Accordingly, Claims 5 and 7 are believed to be patentable for at least the same reasons as discussed above in connection with Claim 1.

Claims 2-4 are dependent claims that depend from Claim 1 discussed above, and, therefore, are submitted to be patentable for at least the same reasons. Since each dependent claim is also deemed to define an additional aspect of the invention, individual reconsideration of the patentability of each claim on its own merits is respectfully requested.

Applicants submit that amended independent Claim 6 is patentably distinct from the combination of Imanaka et al. and Okada et al. at least for the following reasons.

Independent Claim 6 relates to a valve protection method of a liquid discharge head having a heat generating element inside the liquid flow path that is in communication with the discharge port and a movable plate for directing a bubble growing

by a film boiling on the heat generating element to the side of the discharge port. Independent Claim 6 includes the same feature of controlling or stopping the driving to the heat generating element based on a judgment that the ink is present in the ink flow path and whether the ink is normally supplied to the ink flow path, as discussed above in connection with independent Claims 1, 5, and 7. In Claim 6, however, the judgment is made based on the temperature rise detected inside the liquid flow path and the judgment is made only when the temperature rise is more than a predetermined threshold value. Applicants submit that Claim 6 is patentable over Imanaka et al. for the reasons set forth above.

Okada et al. relates to a printhead capable of informing a printer of the existence or the absence of an ink so as to prevent an ink discharge failure. Okada et al. discusses controlling a printhead by detecting a temperature of the printhead. The Office Action states that Okada et al. discloses that when the "temperature rise is more than a predetermined threshold value, a judgment is made (FIG. 8) that the ink is not in a state of being normally supplied and the driving to said heat generating element is controlled or stopped." Even if Okada et al. so teaches this feature, Okada et al. is silent regarding whether the control or stopping of the driving to the heat generating element is based on a judgment that the ink is present in the ink flow path *and* whether the ink is normally supplied to the ink flow path.

Applicants submit that, at least for the reason discussed above, the proposed combination of Imanaka et al. and Okada et al., assuming such combination would even be permissible, would still fail to teach or suggest the feature of controlling or stopping of the driving to the heat generating element based on a judgment that the ink is present in the ink flow path and whether the ink is normally supplied to the ink flow path, as recited in Claim 6. Accordingly, Applicants submit that Claim 6 is patentable over Imanaka et al. and

Okada et al., taken separately or in any proper combination.

In view of the foregoing amendments and remarks, Applicants respectfully request favorable reconsideration and early passage to issue of the present application.

Applicants' undersigned attorney may be reached in our New York Office by telephone at (212) 218-2100. All correspondence should continue to be directed to our address listed below.

Respectfully submitted,

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NY_MAIN 303579 v 1

VERSION WITH MARKINGS SHOWING CHANGES MADE TO CLAIMS (as of 10/31/02)

1. (Amended) A liquid discharge apparatus [provided with] comprising: a discharge port for discharging liquid; a liquid flow path communicating with said discharge port having a bubble generating region for generating a bubble; a discharge energy generating element for generating thermal energy for generating the bubble in the liquid inside said bubble generating region; and a liquid discharge head facing said discharge energy generating element spaced apart from said discharge energy generating element having a movable member in which an end portion at an upstream side in the flow direction of the liquid inside said liquid flow path is fixed and a down stream end thereof is a free end,

in which ink is discharged from said liquid discharge head and a recording is performed by adhering said liquid on a medium to be recorded,

wherein said liquid discharge apparatus comprises:

means for detecting an ink supply state inside said liquid flow path; and

means for controlling or stopping the driving to said discharge energy generating element when a judgment is made that the ink is present in said flow path and the ink is not normally supplied based on the detection result of the ink supply state inside said liquid flow path.

2. (Amended) The liquid discharge apparatus according to claim 1, wherein said means for detecting said ink supply state is a temperature detection means for detecting a temperature rise per unit hour inside the liquid flow path.

3. (Amended) The liquid discharge apparatus according to claim 1, further comprising a driving signal supply means for supplying a driving signal for allowing the liquid to eject from said liquid discharge head.

4. (Amended) The liquid discharge apparatus according to claim 1, further comprising [medium to be recorded] a conveyance means for conveying the medium to be recorded which receives the liquid discharged from said liquid discharge head.

5. (Amended) A valve protection method of a liquid discharge head having a heat generating element inside a liquid flow path communicating with a discharge port and a movable plate for directing a bubble growing by a film boiling on said heat generating element to a side of said discharge port,

wherein an ink supply state inside said liquid flow path is detected and the driving to said heat generating element is controlled or stopped when a judgment is made that an ink is present in said flow path and the ink is not normally supplied based on a detection result of said ink supply state.

6. (Amended) A valve protection method of the liquid discharge head having a heat generating element inside the liquid flow path communicating with the discharge port and a movable plate for directing a bubble growing by a film boiling on said heat generating element to the side of said discharge port,

wherein the temperature rise inside said liquid flow path is detected and, when said temperature rise is more than a predetermined threshold value, a judgment is made that an ink is present in said flow path and the ink is not in a state of being normally supplied and the driving to said heat generating element is controlled or stopped.

7. (Amended) A maintenance system of a movable member for a liquid discharge system, comprising:

a discharge port for discharging a liquid;

a liquid flow path communicating with said discharge port having a bubble generating region for generating [the] a bubble;

a discharge energy generating element for generating thermal energy for generating the bubble in the liquid inside said bubble generating region; and

a liquid discharge head facing said discharge energy generating element spaced apart from said discharge energy generating element having a movable member in which an end portion at an upstream side in the flow direction of the liquid inside said liquid flow path is fixed and a down stream end thereof is a free end, in which by using a liquid supply portion for supplying the liquid to said liquid discharge head, the liquid is discharged,

wherein said maintenance system of said movable member for the liquid discharge system, comprises means for prohibiting or controlling the displacement of said movable member based on an ink being present in said flow path and a liquid supply failure condition in either of a liquid residual state inside said liquid discharge head or liquid supply state to said liquid discharge head from said liquid supply portion.

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